

Fertilizer Calculator for Ohio-User Guide

Version 2020

A Microsoft Excel spreadsheet has been developed to support nutrient management education programs provided by Ohio State University Extension and for users who want to generate their own recommendation or compare recommendations provided to them to the *Tri-State Fertilizer Recommendations for Corn, Soybeans, Wheat, and Alfalfa, 2020*. The spreadsheet is designed to be compatible with Excel version, Excel 1997-2003 or later.

The tool generates recommendations for the following crops:

- 1) Corn
- 2) Corn-Silage
- 3) Soybeans
- 4) Wheat (Grain Only)
- 5) Wheat (Grain & Straw)
- 6) Alfalfa
- 7) Grass Hay
- 8) Grass/Legume Hay

Overview of spreadsheet features:

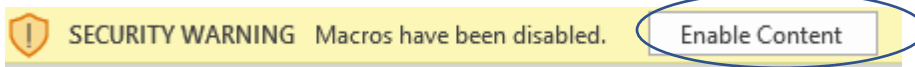
- There are 21 data lines that could be 21 fields or 21 zones within a field.
- The soil test data can be entered by cut/paste from another spreadsheet into the appropriate columns or type entered.
- Crop and yield can be copied down the column after the first entry.
- The user can select by field/data line if they want build/maintenance or maintenance only phosphorus (P) & potassium (K) recommendations.
- User can select when a field has planned long-term wheat, alfalfa, or grass legume hay to use the critical level values for these crops to generate P recommendations.
- Can select a shorter or longer buildup period than standard 4 year for P & K.
- P & K recommendations are displayed with buildup and maintenance requirements separately.
- Total fertility need can be determined for a 1-, 2- or 3-year application on P & K Recommendation page.
- Lime recommendations are developed from target final soil pH and tillage depth.
- User can compare cost of two lime sources on lime recommendation page.
- User can determine total cost of P & K fertilizer needed to meet the nutrient recommendation.
- User can determine total cost of Lime needed in the recommendation developed.

The spreadsheet is available for download at:

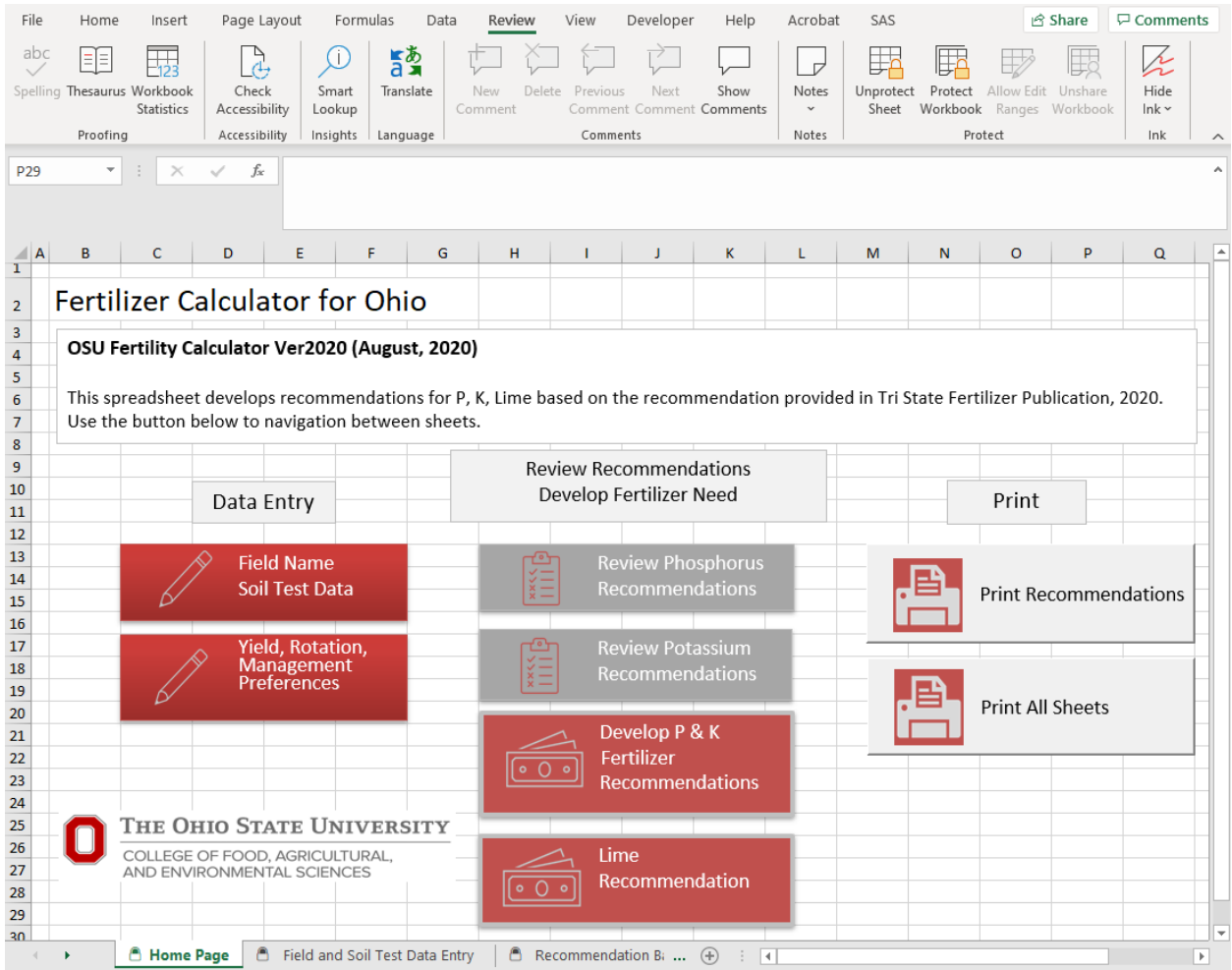
<https://agcrops.osu.edu/file/osufertilitycalculatorver2020xls>

For questions and comments to improve contact Greg LaBarge, Ohio State University Extension, Field Specialist, Agronomic Systems, labarge.1@osu.edu

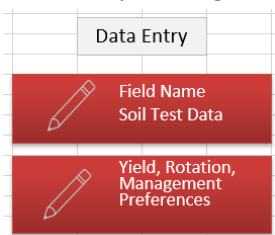
- 1) Once downloaded, open the spreadsheet in Microsoft Excel or compatible program. The spreadsheet contains Macros that must be enable when the file is opened. Click on **Enable Content** to use macros.



- 2) The file will open to the **Home Page** which will guide you to data entry, report sheets and print functions.



- 3) Entry of background data needed to calculate recommendations are made through two pages accessed by clicking on the red button with a pencil icon.



Click on **Field Name and Soil Test Data** to enter data on fields from include in laboratory reports.

- 4) First select the units used on the soil test report either “PPM” or “lbs/A”. The red highlighted box is a pull-down menu. For phosphorus (P) select the extractant being reported either “Mehlich 3” or “Bray P1”. Complete the fields with field identification information, if subsamples were taken for the field use the Subfield Id to name grids or zone then input acres for the area sampled. Soil test values from the lab report are now entered. If a spreadsheet file of results was provided by the lab, the user can copy values from lab report columns and paste into the Fertilizer Calculator for Ohio tool. Once transferred be sure to check that field names and results line up and were not shifted.

#	Field Name	Subfield Id	Acres	P PPM Mehlich 3	K PPM	CEC	pH	Buffer pH
1	Mom's Field	1	50	46	130	18	6.7	6.8
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								

- 5) Once soil test data entry is complete scroll to top of page and click on **Return to Home Page**.
- 6) Access the second page of data entry as noted below.

Click on **Yield, Rotation, Management Preferences** to enter data on fields from include in laboratory reports.

- 7) The recommendations page gives the user the opportunity to make management decisions that will influence phosphorus, potassium, and lime recommendations. Selection may be influenced by owned versus rented land, long term rotation plans and current fertilizer economics.

Red/Pink Boxes Indicate drop down menus and ability to copy and paste down row.
White boxes are number entry.
Gray Boxes can not be changed on this page go back to home page.

Click here to Return to Home Page

Crop Information and Data Used for P, K and Lime Recommendation.									
Start Year for recommendations		2020							
Crop Rotation and Fertility Background Information									
#	Field Name	Subfield Id	Is Wheat, Alfalfa or Grass/Legume Hay regularly planted in this field?	Include P & K buildup in final recs?	Default buildup is over 4 years. Click on cell to select a different length?	Target pH for lime	Depth of tillage (Inches) used for Lime Rec	Crop	Yield Grain (bu/A) Forage (T/A)
1	Mom's Field	1	No	Yes	4	6.8	6	Enter Crop	Enter Crop
2			No	Yes	4	6.8	6	Enter Crop	Enter Crop
3			No	Yes	4	6.8	6	Enter Crop	Enter Crop

Crop Information and Data Used for P, K and Lime Recommendation.

Start Year for recommendations		2020							
Crop Rotation and Fertility Background Information									
#	Field Name	Subfield Id	Is Wheat, Alfalfa or Grass/Legume Hay regularly planted in this field?	Include P & K buildup in final recs?	Default buildup is over 4 years. Click on cell to select a different length?	Target pH for lime	Depth of tillage (Inches) used for Lime Rec	Crop	Yield Grain (bu/A) Forage (T/A)
1	Mom's Field	1	No	Yes	4	6.8	6	Enter Crop	

The questions to answer are noted with the red/pink boxes and include:

- Year - Enter the start year for recommendations.
- Is wheat, alfalfa or grass/legume hay regularly planted in this field? "Yes" or "No" can be selected through a down arrow when the entry box is selected. If answered "Yes" the higher Critical Level of 30 PPM phosphorus is used to generate recommendations for buildup. If "No" is selected a Critical Level of 20 PPM phosphorus is used.
- Include P & K Buildup in final recs? "Yes" or "No" can be selected through a down arrow when the entry box is selected. To exclude Buildup from recommendation, select "No" resulting recommendation is based solely on crop removal where soil test does not exceed maintenance limits.

- d. User can customize buildup period from 3 to 6 years to manage fertilizer cost. The default value used in Tri-State tables is 4 years. A pull down is used to select.
- e. Target pH for lime can be selected as 6.0, 6.5 or 6.8. A pull down is used to select.
- f. Depth of tillage for lime recommendation with adjust lime needed based on farm tillage system and expected incorporation. Depths range from 4-8 inches in 2-inch increments.
- g. Enter the crop using the pull down. A pull down is used to select.
- h. Type in the yield goal.

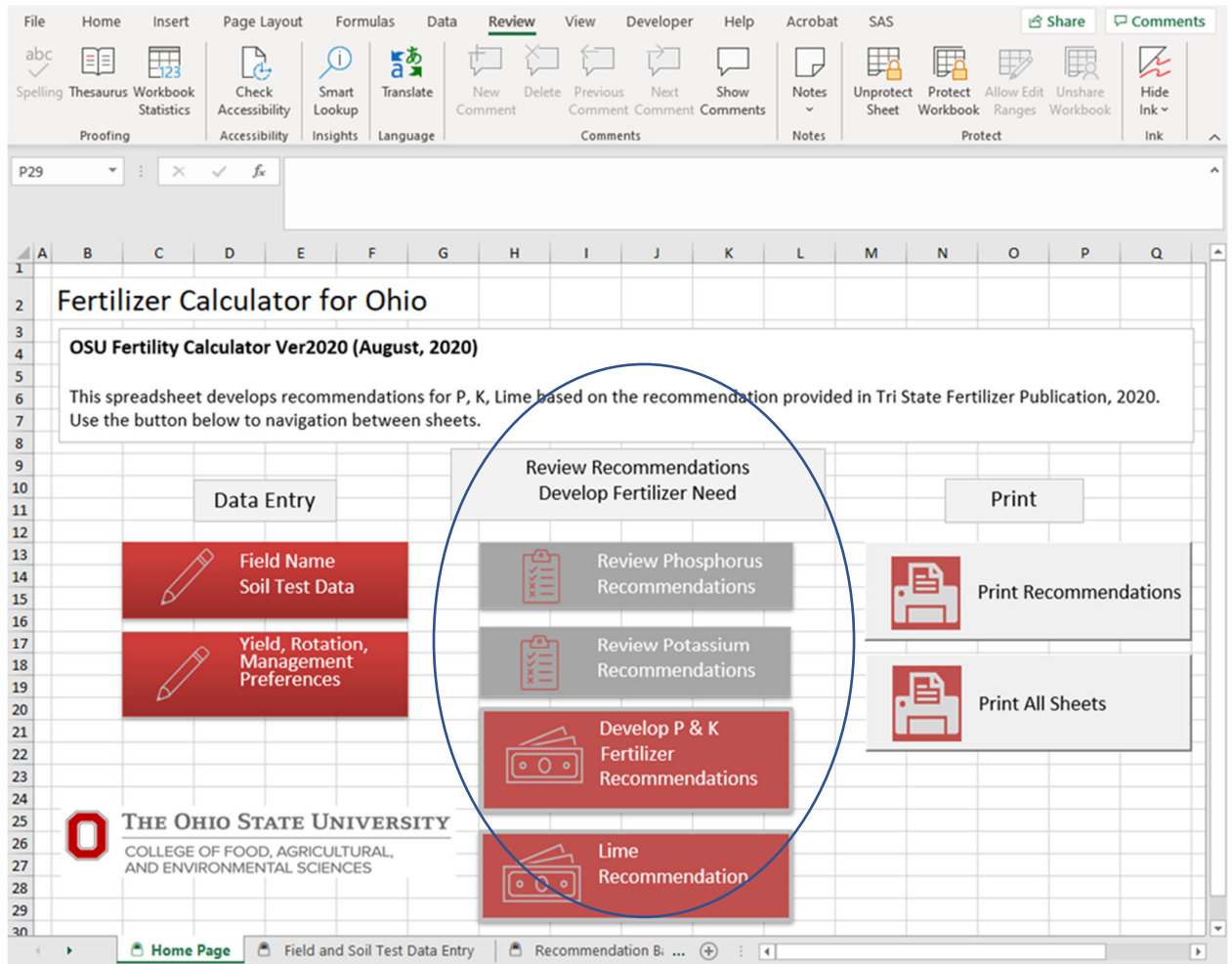
Data Entry Tip. Data can be copied down the column by placing the curser in the lower right-hand corner, clicking so the green outline appears and then pulling down on the lower right corner of the cell. This will work on any column where data entry is repeated from entries made above it.

2020	
	Yield Grain (bu/A) Forage (T/A)
Crop	
Corn	
Enter Crop	Crop Pick List Use Down arrow
Enter Crop	
Enter Crop	
Enter Crop	

Complete Single Field Entry for three crop rotation on **Yield, Rotation, Management Preferences**. Once all fields are entered scroll to top, scroll to top of page and click on **Return to Home Page**.

Crop Information and Data Used for P, K and Lime Recommendation.															
Start Year for recommendations			2020												
Crop Rotation and Fertility Background Information							2020			2021			2022		
#	Field Name	Subfield Id	Is Wheat, Alfalfa or Grass/Legume Hay regularly planted in this field?	Include P & K buildup in final recs?	Default buildup is over 4 years. Click on cell to select a different length?	Target pH for lime	Depth of tillage (Inches) used for Lime Rec	Crop	Yield Grain (bu/A) Forage (T/A)	Crop	Yield Grain (bu/A) Forage (T/A)	Crop	Yield Grain (bu/A) Forage (T/A)		
1	Mom's Field	1	Yes	Yes	4	6.8	6	Corn	180	Soybeans	65	Wheat (Grain Only)	95		

- 8) With field identification, soil test results and management information entered the user is ready to check the nutrient recommendations generated, then develop fertilizer and lime recommendations based on nutrient sources the user will use to meet the nutrient recommendation.



- 9) **Review Phosphorus Recommendations** displays by crop year, the maintenance and buildup P_2O_5 needed based on the soil test and crop rotation.

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Phosphorus Recommendations																
<div> <div>Soil Test P</div> <div>Recommendation by year</div> </div>																
<div> <div>PPM</div> <div>Target</div> <div>2020</div> <div>2021</div> <div>2022</div> </div>																
<div> <div>Field Name</div> <div>Subfield Id</div> <div>Acres</div> <div>Mehlich 3</div> <div>Critical Level (ppm)</div> <div>P_2O_5 Maintain</div> <div>P_2O_5 Buildup</div> <div>P_2O_5 Total</div> <div>P_2O_5 Maintain</div> <div>P_2O_5 Buildup</div> <div>P_2O_5 Total</div> <div>P_2O_5 Maintain</div> <div>P_2O_5 Buildup</div> <div>P_2O_5 Total</div> <div>Note</div> </div>																
<div> <div>1 Mom's Field</div> <div>1</div> <div>50</div> <div>46</div> <div>20</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>48</div> <div>0</div> <div>48</div> <div></div> </div>																

- 10) **Review Potassium Recommendations** displays by crop year, the maintenance and buildup K_2O needed based on the soil test and crop rotation.

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ProofingAccessibilityInsightsLanguageCommentsNotesProtectInk

- 11) The **Fertilizer P and K Recommendation** page gives the user the option to identify the amount and cost of purchased fertilizer needed to meet the nutrient recommendation. The page allows the user to select the years where nutrient recommendations are available to include (A) and enter the analysis and cost of the fertilizer source (B) that would be used. Planned starter phosphorus and potassium can be subtracted by entering the pounds of P_2O_5 or K_2O in the appropriate columns.

Red/Pink Cells Indicate drop down menus to select years to include in fertilizer recommendation. Green Cells for text entry of fertilizer source and any starter used.

Fertilizer P and K Recommendation Page

Select Years to include in Fertilizer Recommendation

	P	K
2020	Yes	Yes
2021	Yes	Yes
2022	No	No

Fertilizer Type

	N (%)	P ₂ O ₅ (%)	K ₂ O (%)	Cost/T	Cost/pound
P Source	11	52	0	400	0.38
K Source	0	0	60	375	0.31

P₂O₅ Recommended Per Acre

P Fertilizer Source

	Total Product per acre	Cost per acre	Total Pounds P Source for Field	Field Cost
2020	0	\$ -	-	\$ -
2021	56	95	0	251
2022	0	79	11,558	3,612

K₂O Recommended Per Acre

K Fertilizer Source

	Total Product per acre	Cost per acre	Total Pounds K Source for Field	Field Cost
2020	251	\$ 79	11,558	3,612
2021	0	0	0	0
2022	0	0	0	0

Field Name

Subfield Id

Acres

2020

2021

2022

Starter P pounds P₂O₅/Ac applied

Starter K pounds K₂O/Ac applied

Field Name

Subfield Id

Acres

2020

2021

2022

Starter P pounds P₂O₅/Ac applied

Starter K pounds K₂O/Ac applied

Field Name

Subfield Id

Acres

2020

2021

2022

Starter P pounds P₂O₅/Ac applied

Starter K pounds K₂O/Ac applied

- 12) On the **Lime Recommendations** page, the user can compare two lime sources (A) based on their cost and effectiveness to neutralize acidity. Needed information include Effective Neutralizing Power (ENP) from the lime analysis available from the lime source and cost information.

In green box enter cost and effectiveness (ENP) data to compare up to two lime sources.

Lime Recommendation Page

Enter Name of Lime Source

	ENP	Cost \$/T Material	Cost \$ per T for Trucking	Cost \$ per Acre Spreading
Local Supply	1500	20	6	5
Cooperative	2000	25	6	5

Field Name

Subfield Id

Acres

CEC

pH (Water)

Buffer pH

Target pH

Tillage Depth

Tons of Lime for target pH and tillage

Tons of material per acre needed from Local Supply

Cost per acre Applied from Local Supply

Tons of material per acre needed from Cooperative

Cost per acre Applied from Cooperative

Note

Field Name

Subfield Id

Acres

CEC

pH (Water)

Buffer pH

Target pH

Tillage Depth

Tons of Lime for target pH and tillage

Tons of material per acre needed from Local Supply

Cost per acre Applied from Local Supply

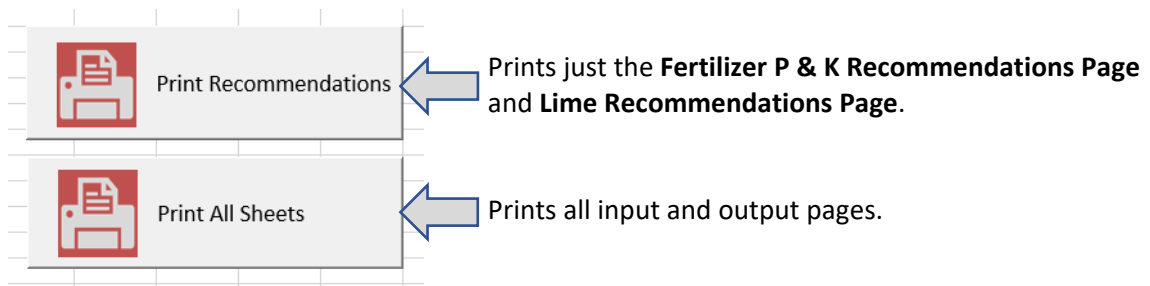
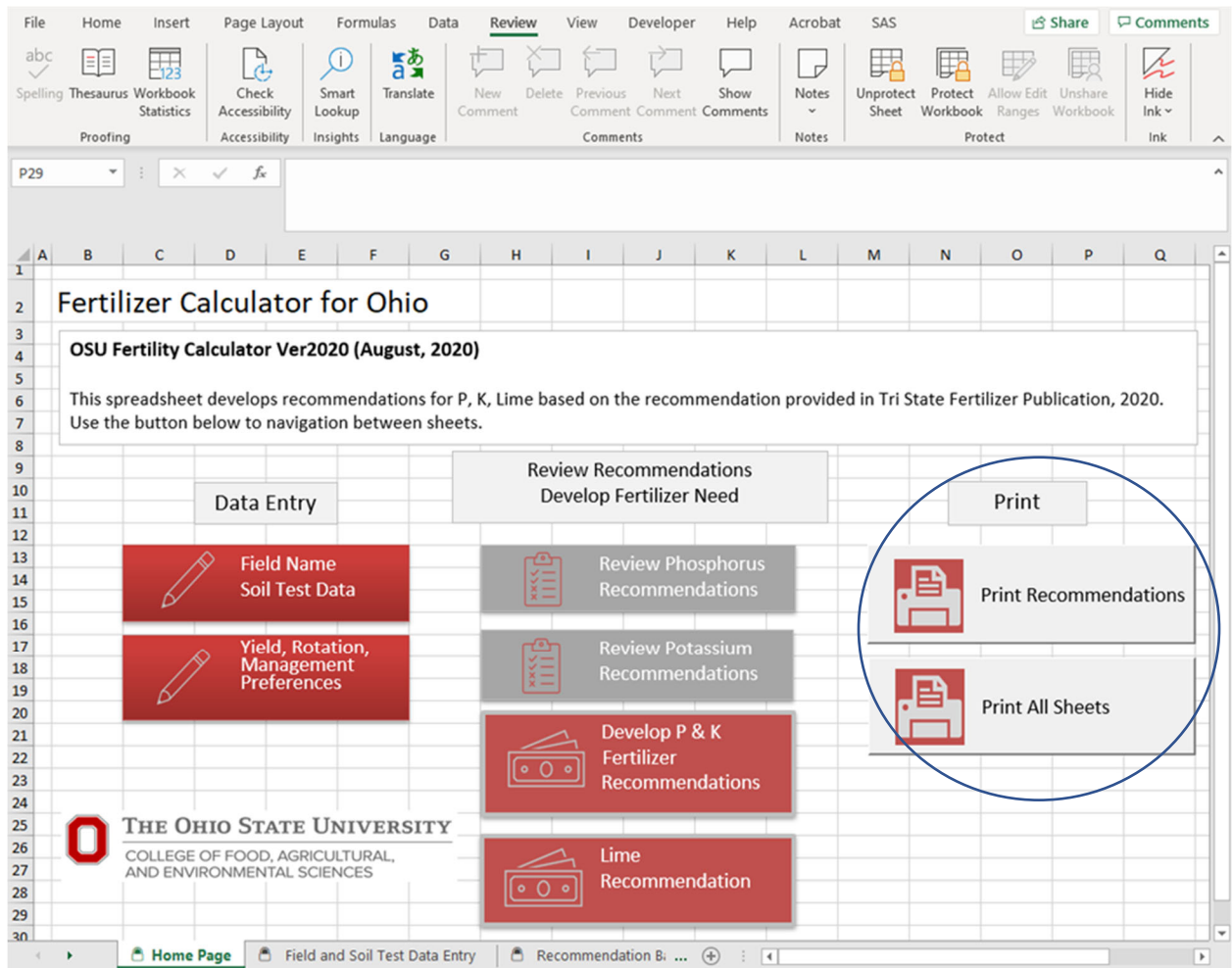
Tons of material per acre needed from Cooperative

Cost per acre Applied from Cooperative

Note

Once the Lime Recommendations are completed, scroll to top of page and click on **Return to Home Page**.

- 13) The print option gives the user the ability to print output to the device selected in Excel for printing.



Appendix 1. Critical levels, crop removal and equations used in Spreadsheet are from Tables 12, 15, 16 and 17 of *Tri-State Fertilizer Recommendations for Corn, Soybeans, Wheat, and Alfalfa, 2020*.

Table 12. Recommended Mehlich-3 Soil Test Phosphorus and Potassium Levels (Critical Level and Maintenance Limit) for Field Crops in the Tri-State Region

Crop	Mehlich-3 Phosphorus Maintenance Range	Mehlich-3 Potassium Maintenance Range	
		Sandy soils (CEC <5 meq/ 100g)	Loam and clay soils (CEC >6 meq/ 100g)
Corn (grain or forage), Soybean	20 – 40 ppm	100 – 130 ppm	120 – 170 ppm
Wheat, Alfalfa	30 – 50 ppm	100 – 130 ppm	120 – 170 ppm

Table 15. Nutrients Removed in Harvested Grain

Crop	Grain Nutrient Removal Rate	
	lbs P ₂ O ₅ / bushel	lb K ₂ O/ bushel
Corn	0.35	0.20
Soybean	0.80	1.15
Wheat	0.50	0.25

Table 16. Nutrients Removed in Harvested Forage Biomass

Crop	Forage Nutrient Removal Rate	
	lbs P ₂ O ₅ / ton	lb K ₂ O/ ton
Wheat Straw	3.7	29
Corn silage	3.1	7.3
Alfalfa	12.0	49

Source: International Plant Nutrition Institute (2014), dry matter basis: 100% for wheat straw and alfalfa; 35% for corn silage (0% moisture for wheat straw, 65% moisture for corn silage).

Table 17. Equations Used for Calculating New Fertilizer Recommendations

Michigan potassium equations are identical to Indiana and Ohio with the exception there is not an additional 20 lbs of K₂O added to crop nutrient removal.

Phosphorus (lbs P ₂ O ₅ / acre to apply)	
Maintenance range	Yield × Nutrient Removal
Build-up range	(Yield × Nutrient Removal) + [(CL – STP) × 5]
Potassium for Indiana and Ohio (lbs K ₂ O/ acre to apply)	
Maintenance range (grain crops)	(Yield × Nutrient Removal) + 20
Maintenance range (forage crops)	[(Yield × Nutrient Removal) + 20] - [((Yield × Nutrient Removal) + 20) × (STK – CL)/50]
Build-up range	[(Yield × Nutrient Removal) + 20] + [(CL – STK) × (1 + (0.05 × CEC))]
Potassium for Michigan (lbs K ₂ O/ acre to apply)	
Maintenance range (grain crops)	Yield × Nutrient Removal
Maintenance range (forage crops)	(Yield × Nutrient Removal) - [(Yield × Nutrient Removal) × (STK – CL)/50]
Build-up range	(Yield × Nutrient Removal) + [(CL – STK) × (1 + (0.05 × CEC))]

Yield = Yield potential in bushels/ acre or ton/acre

Nutrient Removal = Nutrient removal rates from Tables 15 and 16 (lbs/bushel or lbs/ton)

CL = Critical level from Table 12 (ppm)

STP = Soil test phosphorus (Mehlich-3_{ICP} ppm), quantified by inductively coupled plasma emission spectroscopy (ICP)

STK = Soil test potassium (Mehlich-3_{ICP} ppm), quantified by ICP

CEC = cation exchange capacity (meq/100g)

Appendix 2. Notes on Grass Hay and Grass/Legume Hay recommendations.

Grass Hay and Grass/Legume Hay are not included in *Tri-State Fertilizer Recommendations for Corn, Soybeans, Wheat, and Alfalfa, 2020*. The spreadsheet tool for Ohio also contains recommendations for Grass Hay and Grass Legume Hay for P & K. The equations used are the P equations and K the forage equation included in Table 17 above. With the following parameters. Dr. Steve Culman, State Soil Fertility Specialist and Dr. Mark Sulc, State Forage Specialist provide input into this chart.

Crop	Forage Nutrient Removal Rate		Critical-Maintenance Level Mehlich 3-PPM		
	lbs P ₂ O ₅ / ton	lb K ₂ O/ ton	P	K CEC<5	K CEC>6
Grass Hay	12	49	20-40	100-130	120-170
Grass/Legume Hay	12	49	30-50	100-130	120-170